

Schedule 14

DEPARTMENT OF THE INTERIOR

FRANKLIN K. LANE, SECRETARY

U.S. BUREAU OF MINES

VAN. H. MANNING, DIRECTOR

PROCEDURE FOR ESTABLISHING A LIST
OF PERMISSIBLE GAS MASKS

FEES, CHARACTER OF TESTS, AND
CONDITIONS UNDER WHICH GAS
MASKS WILL BE TESTED



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PRELIMINARY STATEMENT.

AUTHORIZATION.

An act of Congress (37 Stat., 681) approved February 25, 1913, contains the following provision in regard to tests or investigations performed by the Bureau of Mines:

That for tests or investigations authorized by the Secretary of the Interior under the provisions of this act, other than those performed for the Government of the United States, or State governments within the United States, a reasonable fee covering the necessary expenses shall be charged, according to a schedule prepared by the Director of the Bureau of Mines, and approved by the Secretary of the Interior, who shall prescribe rules and regulations under which such tests or investigations may be made. All moneys received from such sources shall be paid into the Treasury to the credit of miscellaneous receipts.

The Bureau of Mines will make tests at its Pittsburgh experiment station to establish a list of permissible gas masks and respirators that are safe for use in air containing limited percentages of certain irrespirable gases, vapors, or smokes. As regards their design and approval, gas-mask canisters, or absorbent containers, are subdivided into the following five classes or types:

Type A: For acid gases, such as carbon dioxide, chlorine, formic acid, hydrogen chloride, hydrogen cyanide, hydrogen sulphide, nitrogen peroxide, phosgene, and sulphur dioxide.

Type B: For organic vapors, such as acetone, alcohol, aniline, benzene, carbon bisulphide, carbon tetrachloride, chloroform, ether, formaldehyde, gasoline and petroleum distillates, toluene, and similar volatile compounds.

Type C: For ammonia.

Type D: For other special individual gases.

Type E: For dusts, chemical smokes, fumes, and mists, such as tin tetrachloride, silicon tetrachloride, titanium tetrachloride, and sulphur trioxide.

Type AB, AC, etc.: For combinations of the preceding types.

DEFINITION OF PERMISSIBLE.

The Bureau of Mines considers a gas mask permissible for use in air containing certain irrespirable gas or gases if all the details of construction and the chemical properties of the absorbent are the same in all respects as those of the gas masks that met the requirements and passed the inspection and tests of the Bureau of Mines, as hereinafter described.

CONDITIONS UNDER WHICH GAS MASKS WILL BE TESTED.

The conditions under which the Bureau of Mines will examine and test gas masks to establish their permissibility against gases are as follows:

1. The examination and tests will be made at the experiment station of the Bureau of Mines at Pittsburgh, Pa.

2. Applications for tests shall be addressed to the Director, Bureau of Mines, Washington, D. C., and shall be accompanied by a complete description of the gas mask to be tested, a full set of drawings, showing all the details of construction, and statements that are explained in the next paragraph.

The capacities of absorbents for gases vary over wide limits, depending on the materials used and the conditions under which each lot or batch is manufactured. Hence it will be necessary that each lot obtained by a manufacturer be tested for capacity before being used in gas masks, in order to obtain the standard set by the Bureau of Mines. For these reasons the bureau requires a statement with each application to show the nature, the adequacy, and the continuity of such control provided by the applicant. Tests for approval will be made only after the bureau is satisfied of the effectiveness of such control, and approvals once granted will remain in force only while the control is sustained.

3. A copy of the description, a duplicate set of drawings, a copy of the statements concerning the control of the quality of the absorbents, and two complete gas masks, **identical in every way with those offered for sale**, shall be sent, prepaid, to the Supervising Chemist, Bureau of Mines, 4,800 Forbes Street, Pittsburgh, Pa. In the event of the apparatus successfully passing all of the Bureau of Mines tests and requirements hereinafter specified, one set will be retained by the Bureau of Mines as a laboratory exhibit, and the other will be returned to the owner. In the event that an apparatus does not pass all of the bureau's tests or requirements, both sets will be returned to the owner.

4. Each gas mask shall have marked on it in a distinct manner the name of the manufacturer and the name, letter, or number by which the type is designated for trade purposes, and a written statement shall be made whether or not the apparatus is ready to be

marketed. No gas mask will be tested unless it is in the completed form in which it is to be put on the market.

5. As soon as possible after the receipt of his application for test, the manufacturer will be notified of the date on which his gas mask will be tested, and the material that it will be necessary for him to submit.

6. All material for test shall be delivered by the manufacturer to the Supervising Chemist, Bureau of Mines, 4800 Forbes Street, Pittsburgh, Pa., not less than one week prior to the date set for the test.

7. No one is to be present at these tests except the necessary Government officials, their assistants, and one representative of the manufacturer of the gas mask to be tested, who shall be present in the capacity of an observer only.

8. The conduct of the tests shall be entirely in the hands of the bureau's representatives in charge of the investigation.

9. The tests will be made in the order that the applications for test are received, provided the necessary material is submitted at the proper time.

10. The details of the results of tests shall be regarded as confidential by all present at the tests, and shall not be made public in any way prior to their official publication by the Bureau of Mines.

11. The results of tests of the gas masks that fail to pass the requirements shall not be made public, but shall be kept confidential, except that the person submitting the apparatus will be informed with a view to possible remedy of the defects in future gas masks submitted, but such changes will not be permitted while testing is in progress.

12. Tests will be made for manufacturers or accredited manufacturers' agents and for inventors.

13. A list of permissible gas masks and respirators and the results of their tests will be made public from time to time by the Bureau of Mines.

REQUIREMENTS FOR BUREAU OF MINES APPROVAL.

To obtain the approval of the Bureau of Mines, a gas mask or respirator must pass successfully the inspection and tests described below:

1. *Color and markings.*—Distinctive color and markings to indicate the purpose of each canister or absorbent container are required for the purpose of safeguarding the wearers. The colors required are indicated in the table following.

Table of colors to indicate purpose of masks.

Mask type-letter.	Chemical properties of gases absorbed.	Distinctive color required.
A.....	Acid.....	White.
B.....	Organic vapor.....	Black.
C.....	Ammonia.....	Green.
D.....	Other special individual gases.	Color to be assigned.
E.....	Dusts, smokes, mists.....	White or black stripes.
AB.....	Acid and organic vapors..	Yellow.
Combinations of those above.	Combinations of those above.	Combinations of those above. When a dust filter is combined with a gas respirator, it is to be indicated by black or white stripes.

The canisters, or containers, for the absorbent material shall be either painted completely in these colors or the color shall be made a distinctive part of the canister design. On the canister shall be indicated, in bold letters, this statement:

FOR USE ONLY IN
(Name of gas or gases.)

The manufacturer will state the gas or gases, or classes of gases, in which the gas mask is to be used. For this purpose, it is permissible to attach a metal plate bearing the proper inscription in raised or other distinct letters, or to stamp the statement into the metal of the can with a male and female die. The statement may be printed or stenciled with paint, or paper labels may be used. The latter must be attached with a heat-proof cement and varnished to prevent loosening by moisture. This statement may be made a part of the approval plate described on page 11.

If a dust respirator is combined with gas absorbents, the fact should be indicated, as for example:

FOR USE ONLY IN **AND IN DUSTS.**
(Name of gas or gases.)

The knapsack or case in which the gas mask is kept must also have the same statement indicated conspicuously in bold letters. The distinctive color or colors may be that of the letters themselves or that of the background, or part of the design, in such fashion that the distinctive colors are prominent.

Metal plates or painted or printed stencils may be used on the knapsacks, but paper labels will not be permissible here.

For chemical smokes or fumes, the canister or container for the absorbent material shall be of a color to indicate the purpose of the absorbent material contained, and shall be striped with a strongly contrasting color, either black or white, to indicate the filters. The stripes may be placed so as to indicate the number and position of the filters. On the canister or container shall be indicated, in bold letters of contrasting color, this statement.

FOR USE ONLY IN -----

(Name of gas or gases and of chemical fume, according to the purpose of the manufacturer.)

The knapsack or case in which the gas mask is kept must also have the same statement indicated, in bold letters on a striped background of the proper colors, to indicate the purpose of the absorbent and the filter.

2. *Materials*.—The gas mask and equipment must be constructed in all its parts of materials suitable for the purpose they must serve. This applies to the fabric, rubber, metal, chemical, and other parts.

3. *Design and construction*.—The excellence of design and mechanical construction, as well as the workmanship, will be considered. This will be done with regard to safety to the wearer, freedom of his movements and his vision, the fit of the face and head pieces and the comfort that is afforded under all conditions of use. There will also be considered the ease with which canisters or other parts of necessarily short life may be replaced by fresh parts, and the tightness of the whole apparatus, with a view to insuring the wearer against leaks of unpurified air, both before and after such changes are made.

4. *Face-piece test*.—Two men wearing the gas masks will enter a room containing 1 per cent of sulphur dioxide; if necessary, a canister for acid gases will be attached to the mask for this test. Thirty minutes will be spent in work designed to provide observations on the freedom of movement permitted, freedom from leaks, and the comfort allowed to the wearer. The time will be divided as follows:

10 minutes. Walking, turning head, dipping chin.

5 minutes. Calisthenic movements, such as swinging arms, turning body, bending body at hips.

10 minutes. Sitting at rest, then walking and easy movements.

5 minutes. Pumping air into gas cylinder of about 1 cubic foot capacity, with a tire pump, to a pressure of 25 pounds.

To meet approval, it will be necessary that no sulphur dioxide come through the mask during the test, and that no undue discomfort be experienced because of the fit or other mechanical features of the gas mask.

5. *Resistance to flow of air.*—

(a) Before and after the chemical tests described under paragraphs 6 and 7, the pressure drop of air passing through the canisters at a rate of 85 liters per minute will be determined in inches of water-column height. At no time must the resistance exceed 4 inches of water.

(b) The resistance to flow of air of the complete mask and canister, to inspiration and to expiration, will be determined on a mechanical apparatus, the rate being 85 liters per minute continuous flow; the resistance must not exceed 6 inches of water pressure.

6. *Canister tests.*—

Type A, acid gases: Nine canisters or parts containing the absorbent, separated from the face pieces and harness, will be tested on a chemical testing apparatus under these conditions:

(a) Number of canisters. Three.

Gas used for testing. Chlorine.

Concentration of chlorine in air. 5,000 parts per million.

Humidity. 50 per cent relative humidity.

Temperature. Room temperature (approximately 25° C.).

Rate of flow of gas. 32 liters per minute, continuous flow.

(b) Number of canisters. Three.

Gas used for testing. Hydrogen cyanide.

Concentration of hydrogen cyanide in air. 5,000 parts per million.

Humidity. 50 per cent relative humidity.

Temperature. Room temperature (approximately 25° C.)

Rate of flow of gas. 32 liters per minute, continuous flow.

(c) Number of canisters. Three.

Gas used in testing. Sulphur dioxide.

Concentration of sulphur dioxide in air. 5,000 parts per million.

Humidity. 50 per cent relative humidity.

Temperature. Room temperature (approximately 25° C.).

Rate of flow of gas. 32 liters per minute, continuous flow.

Tested in this way, the life or service time of each canister must be at least 20 minutes. The end of the life will be the time at which a test shows 5 parts per million of chlorine, hydrogen cyanide, or sulphur dioxide in the air coming from the canisters.

Type B, organic vapors: Three canisters or parts containing absorbent, separated from the face pieces and harness, will be tested on a chemical apparatus under the following conditions:

Vapor used for testing. Carbon tetrachloride.

Concentration of carbon tetrachloride in air. 5,000 parts per million.

Humidity. 50 per cent relative humidity.

Temperature. Room temperature (approximately 25° C.).

Rate of flow of gas. 32 liters per minute, continuous flow.

Tested in this way, the life or service time of each canister must be at least 20 minutes. The end of the life will be the time at which the air, after passing through the canister, imparts a green color to a small gas flame containing some of the air admixed with the gas and impinging on a clean copper wire.

Type C, ammonia: Three canisters containing the absorbent, separated from the face pieces and harness, will be tested on a chemical testing apparatus, under the following conditions:

Concentration of ammonia in air. 20,000 parts per million, or 2 per cent by volume.

Humidity. 50 per cent relative humidity.

Temperature. Room temperature (approximately 25° C.).

Rate of flow of gas. 32 liters per minute, continuous flow.

Tested in this way, the life or service time must be at least 20 minutes. The end of the life will be the time at which the air, after passing through the canister, contains 100 parts per million, or 0.01 per cent by volume, of ammonia.

Type D, other special individual gases: Similar tests will be performed on other special gases, and will be arranged as the need arises.

Type E, smoke, dust, and mist filters: Three filters, separated from the face piece and harness, will be tested on a smoke-testing apparatus under these conditions:

Fume used. Tobacco smoke.

Rate of flow of gas. 85 liters per minute.

Length of test. 5 minutes.

Tested in this way, the filter must retain at least 95 per cent of the passing tobacco smoke at the end of the 5-minute period.

Other types: Combinations for different types of gases, as above. Canisters may be tested according to two or more methods, under Types A, B, C, D, and E, to secure approval for different gases classed under the different types.

To meet the approval of the Bureau of Mines, it will be necessary that the life for gases in each class or type be equal to the separate requirements.

7. *Chemical stability*.—To determine the chemical stability under extreme conditions of dryness and moisture, two canisters will be subjected to each of the following tests for which approval is desired:

(a) Air free of carbon dioxide, at room temperature and 25 per cent relative humidity, will be passed through each canister, at a rate of 64 liters per minute, for a period totaling 6 hours. The

canisters will then be tested, as described under paragraph 4, against gases, as follows:

Approval for acid gas. Chlorine.

Approval for organic vapor. Carbon tetrachloride.

Approval for ammonia. Ammonia.

Approval for special gas. Special gas to be arranged.

Approval for dusts and mists. No test.

Approval for combinations. Any two or more of the above.

To meet approval, the life of the canisters must not fall below 10 minutes in any test.

(b) Air free of carbon dioxide, at room temperature and 85 per cent relative humidity, will be passed through each of two canisters at a rate of 64 liters per minute, for a period totaling 6 hours, and the canisters will then be tested as described in (a) above.

To meet approval, the life of the canisters must not fall below 10 minutes in any test.

8. *High rates of breathing and maximum concentration.*—To insure protection to the wearer at high rates of breathing in gas of high concentration, a stream of air containing 1 per cent of gas and flowing at a rate of 64 liters per minute will be passed continuously through a canister. The other conditions of the tests will be these:

Humidity. 50 per cent relative humidity.

Temperature. Room temperature (approximately 25° C.).

Gas used in testing—

Approval for acid gas. Phosgene.

Approval for organic vapors. Carbon tetrachloride.

Approval for special gas. Ammonia, or other special gas.

Approval for dusts and mists. No test.

Approval for combinations. Any two or more of the above.

Concentration. 10,000 parts per million, or 1 per cent by volume, for any gas.

Number of canisters. Two, tested against any gas.

To meet the approval of the Bureau of Mines, the life of the canisters under any of the above tests against gas must be at least five minutes.

APPROVAL FOR HIGHER CONCENTRATIONS.

The Bureau of Mines requires that a gas mask pass the tests outlined in the preceding paragraphs in order to obtain approval for use in concentrations of 1 per cent of gas, which is the minimum for which the bureau will grant approvals. To obtain approval for higher concentrations, the canister must pass tests similar in every way to those that have been described, except that the concentration is increased in test 8 in steps of 1 per cent, as far as practicable, and these tests are made on each gas for which approval in higher con-

centrations than 1 per cent is desired. Approval will be granted for use of the gas masks in the maximum concentration for which they successfully pass the test.

CHANGING OF DETAILS OF TESTS.

If the mechanical or other features of a gas mask render it advisable to omit any of the tests or part of a test previously described, or to perform accessory tests, the bureau reserves the right to modify the test in such manner as to obtain substantially the same information and degree of safety as is provided by the tests described.

APPROVAL OF PERMISSIBLE GAS MASKS.

The manufacturer will be required to attach to the canisters used with the respirators a plate bearing the seal of the Bureau of Mines and inscribed as follows:

PERMISSIBLE GAS MASK (OR RESPIRATOR) FOR IN CONCENTRATIONS
NOT EXCEEDING PER CENT.

U. S. BUREAU OF MINES APPROVAL No.

The manufacturer will insert in the blanks the name or names of any or all gases for which the gas mask was approved. The plate may be fashioned in any way, as described on page 6.

NOTIFICATION OF MANUFACTURER.

As soon as the bureau's chemists are satisfied that a gas mask is permissible, the manufacturers of the mask and the public-safety departments of the several States shall be notified to that effect. As soon as a manufacturer receives formal notification that his gas mask has passed the tests prescribed by the bureau, he shall be free to advertise such a gas mask as permissible.

SCOPE OF APPROVAL.

The bureau's approval of any gas mask shall be construed as applying to all gas masks made by the same manufacturer that have the same construction in all details and have equal chemical qualities in the absorbent, as considered by the bureau.

As stated on page 4, chemical control of the quality of the absorbent must be sustained by the manufacturer during the time that the approval is operative.

WITHDRAWAL OF APPROVAL.

The Bureau of Mines reserves the right to rescind for cause at any time any approval granted under the conditions as herein set forth. At times gas masks or parts may be purchased on the open market by the Bureau of Mines and tested. Failure to meet the requirements for approval will be cause for withdrawing the approval granted.

FEEES FOR TESTING GAS MASKS.

The following schedule of fees to cover expenses to be charged on and after May 22, 1919, has been established and approved by the Secretary of the Interior, in accordance with the provisions of the statute previously quoted:

Table of costs for approval.

Types of gas mask.	Examination and test of complete mask with canister.	Examination and test of canister only.	Additional tests and examination of canister in connection with other tests.
A.....	\$200.00	\$170.00	\$150.00
B.....	140.00	105.00	85.00
C.....	150.00	110.00	40.00
D.....	225.00	190.00	155.00
E.....	100.00	65.00	50.00
AB.....	285.00	255.00	235.00

The costs stated above are for maximum concentrations of 1 per cent. Tests for approval of gas masks at concentrations higher than 1 per cent will cost \$40 in addition to the costs given in the preceding table, for each gas investigated.

The fees specified herein may be increased to cover the cost of testing an unusually complicated apparatus, or performing unusually difficult tests, and are also subject to change upon the recommendation of the Director of the Bureau of Mines and the approval of the Secretary of the Interior.

REMITTANCES.

Manufacturers who submit gas masks for tests to determine their permissibility will be required to furnish certified check or bank draft, made payable to the Secretary of the Interior, to cover the fee for the tests. Such fee must be received at least two weeks prior to the date set for beginning the tests; otherwise, the equipment of the next applicant upon the list will be tested.

SYNOPSIS OF PROCEDURE TO BE FOLLOWED IN MAKING APPLICATIONS FOR TESTS, SUBMITTING MATERIAL, CONDUCTING TESTS, AND NOTIFYING APPLICANT OF RESULTS.

1. Application for tests should be addressed to the Director of the Bureau of Mines, Washington, D. C. This application should be accompanied by check or draft, a complete description of the respirator to be tested, a statement to show the nature, adequacy and

continuity of the chemical control of the absorbent material which is to be maintained by the applicant, and a set of drawings described in paragraph 2, page 4. Duplicate copies of the application, description, statements, and drawings should be sent to the Supervising Chemist, Bureau of Mines, 4800 Forbes Street, Pittsburgh, Pa., accompanied by two complete gas masks.

2. As soon as the application has been received by the bureau's chemists, the applicant will be notified of the date of the tests and the number of gas masks it will be necessary for him to submit.

3. After receiving this notification, the applicant should send the material required to the Supervising Chemist, Bureau of Mines, 4800 Forbes Street, Pittsburgh, Pa. The material should be delivered not less than one week in advance of the date set for the beginning of the tests. At this time, the applicant should state the name and address of the applicant's representative who will witness the tests.

4. The tests will be begun on the date set and continued until the gas mask is approved, rejected, or withdrawn.

5. After the bureau's chemists have considered the results of the tests, a formal report of the approval or disapproval of the respirator will be made to the applicant in writing by the Director of the Bureau of Mines. No verbal report will be made, and the details of the tests must be regarded as confidential by all present.

(Signed)

VAN. H. MANNING,

Director.

Approved: May 22, 1919.

JOHN W. HALLOWELL,

Assistant to the Secretary.



